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Efficiency of soft X-ray radiation reprocessing in supersoft X-ray sources

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Abstract

We evaluate the reprocessing efficiency for soft X-rays in irradiated accretion discs of supersoft X-ray sources. Our investigation is based on the assumption that the structure of the atmosphere of the flat inner accretion disk and the elevated disk rim is close to that of a stellar atmosphere. We have constructed an analytical two-color X-ray irradiated model atmosphere of the accretion disc and consider its main features. We compute X-ray irradiated stellar model atmospheres using the modified Kurucz code ATLAS5. We obtained an analytical expression for the X-ray albedo Ax. We show that spectral line acceleration is larger than gravity in surface layers of X-ray irradiated model atmospheres. We found that the reprocessing efficiency for soft X-rays is rather small due to the fact that the soft X-rays are absorbed high in the atmosphere and cannot penetrate to the visual light formation depth. This results contradicts the observation of supersoft sources as very bright blue objects. Since the disc rim is the only possible source of this visual light we suspect that the blobby structure of the elevated rim and the spray area, both connected with the impinging accretion stream, might be the reason for this discrepancy.

Keywords

Accretion, accretion disks, Radiative transfer, Stars: Novae, cataclysmic variables, X-rays: Stars